J. Raptor Res. 23(1):18–19

COMMENTARY

EFFECTS OF STRYCHNINE ON RAPTORS

STANLEY N. WIEMEYER

Cheney et al. (1987) recently reported on the effects of strychnine on raptors. Three individual raptors of 2 species were used to determine the effects of sublethal doses of strychnine on motor function, acquisition of taste aversion and behavior. Some of the methods used in this series of experiments were inappropriate, therefore the results and conclusions may be invalid.

First, the sample sizes of birds used in the experiments were far too small to provide meaningful results that can be extrapolated to the field with any degree of confidence. Only one Red-tailed Hawk (*Buteo jamaicensis*) and 2 Great Horned Owls (*Bubo virginianus*) were used in the study which encompassed 5 different experiments. Greater numbers of birds, possibly 5/species, should have been used for each experiment. A minimum of 3 subjects is required in statistical analyses to estimate variability. Thus, statistical credibility in the study was lacking.

Secondly, using the same individual birds in >1 experiment is inappropriate. A basic premise in toxicological research is that animals should not be previously treated with test substances in other studies (Chan et al. 1982). In Experiment One as described by Cheney et al. (1987) 3 birds were repeatedly exposed to strychnine at increasing doses. The first or early exposure(s) could have affected tolerance of the birds to later exposures to strychnine through several routes, including sensitization or desensitization. The objective of Experiment One can only be met by using previously unexposed subjects, not through repeated exposure of the same subjects. In Experiments One and Two, Cheney et al. (1987) dosed birds on alternate days which was assumed to allow sufficient time for elimination of the toxin, but they later stated ". . . complete elimination may take several days." No evidence was provided that strychnine did not accumulate in the birds. Hudson et al. (1984) found delayed mortality in California Quail (*Callipepla californica*) dosed with strychnine, which suggests that irreversible effects may occur. Cheney et al. (1987) provided no evidence that irreversible effects do not occur following sublethal exposure to strychnine. Conceivably, strychnine exposure could affect the immune system or mixed function oxidases. The basic premise was also violated in Experiment Three where birds, previously treated with strychnine, were fed mice injected with lithium chloride and dipped in vinegar to determine if food aversion could be learned. Whether the birds averted to food because of the vinegar, the lithium chloride, or preexposure to strychnine in combination with one of these was unclear. Sequential experiments using the same 3 birds might have confounded results within or between experiments, an issue that was not addressed by the authors.

Thirdly, no "controls" (undosed birds) were used in the experiments. Their absence is most conspicuous in Experiments Two, Three and Four. Undosed subjects are necessary for proper interpretation of data from treated subjects in toxicological research.

We live in a time when the activities of the research community are being closely scrutinized in relation to how animals are treated. One general consideration in conducting research is that the procedures used should avoid or minimize distress and pain, in keeping with the design and objectives of the study. Also, "Studies should use the fewest animals necessary to answer reliably the questions posed. Use of adequate samples at the outset will prevent unnecessary repetition, resulting in waste or increased distress" (A.O.U. 1988). Cheney et al. (1987) recognized that strychnine increases the excitability of the central nervous system and described instances where treated birds flew against the cage wall and/or fell to the ground in response to dosage and the presence of an investigator. Such behavior clearly involves distress and possibly pain and appears to have occurred repeatedly in the same birds in >1 experiment. Whether such treatment was related to study objectives in all cases was unclear. Treatment of study animals that causes pain and distress must be carefully justified. Otherwise the research community will come under increasingly heavy attack and could eventually be prevented from performing critically needed research. Inadequate design and inappropriate methods used by Cheney et al. (1987) negate the value of the information gained and therefore offer little support for the use of and distress to the Red-tailed Hawk and Great Horned Owls in their study. Toxicological research that is adequately designed and justified should be continued.

I thank C. E. Grue, E. F. Hill, J. L. Lincer, G. H Olsen and M. R. Whitworth for their helpful comments and discussions in relation to the preparation of this commentary.

LITERATURE CITED

AMERICAN ORNITHOLOGISTS' UNION. 1988. Report of the Committee on the use of Wild Birds in Research *Auk* 105(1, suppl.): 1A–41A.

CHAN, P. K., G. P. O'HARA AND A. W. HAYES. 1982.

Principles and methods for acute and subchronic toxicity. Pages 1–51. *In* A. W. Hayes, ED. Principles and methods of toxicology. Raven Press, New York.

CHENEY, C. D., S. B. VANDER WALL AND R. J. POEHLMANN. 1987. Effects of strychnine on the behavior of Great Horned Owls and Red-tailed Hawks. *J. Raptor Res.* 21:103–110.

HUDSON, R. H., R. K. TUCKER AND M. A. HAEGELE. 1984. Handbook of toxicity of pesticides to wildlife (2nd ED.). U.S. Department of the Interior, Fish and Wildlife Service, Resource Publication 153.

U.S. Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland 20708.

Received 10 June 1988; accepted 9 December 1988